

to the most simple for digesting *vegetable* food, so those of the bullock, camel, and whale, are links from the ruminating to the most simple stomachs for digesting animal food ; and the camel's stomach is the most important link in each series, the contraction peculiar to its fourth cavity making it intermediate between the bullock and the whale.

Although the above facts appear to throw some light on the digestion of different kinds of food, they also present difficulties which must remain to be explained when further progress has been made in the investigation. It is in general admitted, that animal substances do not require so long a process to convert them into chyle as vegetables ; and hence the stomachs of carnivorous animals are in general most simple : but why the whale tribe, which live on fish that are very readily converted into chyle, should have a more complex stomach, it is not easy to explain. What further uses, in regard to other secretions, these preparatory stomachs may have, are foreign to the design of the present paper, which Mr. Home considers as a continuation of a series of observations on digestion, and hopes to extend further at some future opportunity.

*On the Formation of the Bark of Trees. In a Letter from Thomas Andrew Knight, Esq. F.R.S. to the Right Hon. Sir Joseph Banks, K.B. P.R.S. &c. Read February 19, 1807. [Phil. Trans. 1807, p. 103.]*

An extraordinary diversity of opinion having prevailed amongst naturalists most capable of correct observation, respecting the production and subsequent state of the bark of trees, Mr. Knight has undertaken to investigate the subject : but such are the difficulties of the subject, that, in a course of experiment which has occupied more than twenty years, he has scarcely felt himself prepared, till the present time, even to give an opinion of the manner in which the cortical substance is either generated in the ordinary course of its growth, or re-produced when that which previously existed has been taken off.

Du Hamel had shown, that the bark of some species of trees is readily re-produced when the decorticated alburnum is secluded from the air. Mr. Knight has repeated these experiments on the apple, the sycamore, and some other trees, with the same result ; and has also observed, that the wych-elm, in moist and shady situations, will frequently re-produce its bark when no covering whatever has been applied.

A glairy fluid (as Du Hamel justly observes) exudes from the surface of the alburnum, which appears to change into a pulposus organized mass, and subsequently becomes organized and cellular,—facts which are extremely favourable to the opinion of Hales, that the bark is derived from the substance of the alburnum. But other facts may be adduced which lead to a contrary conclusion ; since the internal surface of pieces of bark, when detached from contact with the alburnum, but remaining united to the tree at their upper

ends, will much more readily generate a new bark than the alburnum does under similar circumstances. A similar fluid exudes, and the same phenomena are observable, in both cases. The cellular substance, however, which is thus generated is for some time very imperfectly organized, since the vessels which carry the true sap are at first wanting; but Mr. Knight has been enabled to trace their progress, and, by appropriate management, to direct the course of their growth laterally or downwards with a greater or less degree of inclination; but observes, that their natural tendency is perpendicularly downwards, and that they cannot be made to extend themselves upwards excepting to a very short distance.

Mr. Knight having thus satisfied himself that both the alburnum and the bark of trees are capable of generating new bark, or at least of transmitting a fluid to which the bark owes its existence, his attention was next directed to discover the sources from which this fluid is derived.

Both the bark and the alburnum, he observes, are composed principally of two substances, one of which consists of long tubes, the other is cellular; and the cellular substance of the bark is in contact with a similar substance in the alburnum. Mr. Knight has shown, in former communications, that the true sap of trees acquires those properties which distinguish it from the fluid recently absorbed, by circulating through the leaf; that it descends down the bark, where part of it is employed in generating the new substance annually added to the tree; and that the remainder, not thus expended, passes into the alburnum, and there joins the ascending current of sap.

In the preceding experiments the cellular substance, both of the bark and alburnum, has been proved to be capable of affording the sap a passage through it; and it therefore appears not very improbable that it executes an office similar to that of anastomosing vessels in the animal economy, when the cellular surfaces of the bark and alburnum are in contact with each other; and hence the passing fluid is capable of exuding from both surfaces when they are detached; because almost all the vessels of trees are capable of an inverted action in giving motion to the fluids they contain.

Since the power of generating new bark appeared to reside alike in the sap of the bark and in that of the alburnum, Mr. Knight endeavoured to ascertain whether the fluid which ascends through the central vessels of the succulent annual shoot possesses similar power. For this purpose he removed the bark between two circular incisions round several annual shoots of the vine; and having taken care to prevent the formation of new bark on the surface of the alburnum, he, after a day or two, made longitudinal incisions through the dry and lifeless alburnum. These incisions commenced a little above and extended a little below the decorticated spaces. A cellular substance was in consequence generated through the whole length of the incision, and a perfect vascular bark was subsequently formed, and appeared to execute the office of that which had been removed, although placed beneath the alburnum.

The medulla in this case appeared to be wholly inactive.

By an examination of buds which had been inserted in a preceding summer, or attached by grafting in the spring, it appeared that vessels diverged from them into the bark of the stock.

It seems therefore probable, that a pulposus organizable mass first derives its matter from the bark or alburnum, and that this matter subsequently forms the new layer of bark; for if the vessels had proceeded as radicles (according to Darwin's supposition,) from the inserted buds or grafts, such vessels would be different from the natural vessels of the stock; neither is it probable that vessels could extend, by actual addition to their extremities in the course of a few days, from the leaves to the roots. Mr. Knight is consequently inclined to believe that the matter itself which composes the new bark acquires an organization of vessels calculated to carry the true sap; but whether, in the ordinary growth of trees, this matter be derived from the bark or the alburnum, or from both, it will be extremely difficult to determine. This, however, is certain, that bark in many cases exists previous to the existence of alburnum; but there seems to be no case, in the ordinary growth of vegetables, in which alburnum exists previous to the formation of bark.

*An Investigation of the general Term of an important Series in the inverse Method of finite Differences.* By the Rev. John Brinkley, D.D. F.R.S. and Andrews Professor of Astronomy in the University of Dublin. Communicated by the Astronomer Royal. Read February 26, 1807. [*Phil. Trans.* 1807, p. 114.]

*On Fairy-rings.* By William Hyde Wollaston, M.D. Sec. R.S. Read March 12, 1807. [*Phil. Trans.* 1807, p. 133.]

In this paper the author relates briefly some observations which he formerly made on the progressive changes of these rings, which appear to him to lead to a satisfactory explanation of their origin.

In the first place he observed, that some species of fungi were always to be found at the exterior margin of the dark ring of grass if examined at the proper season. This position of the fungi led him to conjecture that progressive increase from a central point was the probable mode of formation of the ring; and he thought it likely that the soil which had once contributed to the support of fungi, might be so exhausted as to be rendered incapable of producing a second crop. The defect of nutriment on one side would occasion the new roots to extend themselves solely in the opposite direction, and would cause the circle of fungi continually to proceed, by annual enlargement, from the centre outwards. The luxuriance of the grass follows as a natural consequence, as the soil of an interior circle is enriched by the decayed roots of fungi of the succeeding year's growth. Such a progressive enlargement, he remarks, had already been observed by Dr. Hutton on the hill of Arthur's Seat near Edinburgh; but Dr. Hutton had not attended to the production of fungi.